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Original Article

Constipation in Taiwan elementary school students: A nationwide survey

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Abstract

Background: To evaluate the prevalence and associated factors of childhood constipation in Taiwan.
Methods: Healthy children between 7 and 12 years of age were interviewed to determine the prevalence of constipation and associated demographic and dietary factors. A nationwide sample of 2,375 children was selected with complex multistaged sampling throughout Taiwan.
Results: In total, 2,375 individuals (1,282 boys and 1,093 girls, mean age = 9.3 ± 2.2 years) were interviewed, with a response rate of 95.1%. The prevalence of constipation was 32.2%, and girls were more likely to have constipation than boys (36.1% *vs.* 29.2%, $p = 0.0012$) in this study. The prevalence of constipation was inversely related to age (24.4% for children aged 11 and 12, 34.0% for children aged 9 and 10, and 39.6% for children aged 7 and 8, $p < 0.001$). Constipated children were more likely to report irregular bowl movements (37.2% *vs.* 29.3%, $p = 0.003$), and constipated children had a significantly lower body mass index (17.5 kg/m^2 *vs.* 18.3 kg/m^2, $p < 0.001$). The dietary intake for children with constipation was associated with lower intake of vegetables (4.2 servings/week *vs.* 5.8 servings/week, $p < 0.05$), fruits (5.6 servings/week *vs.* 7.0 servings/week, $p < 0.05$), soybean products (2.2 servings/week *vs.* 2.9 serving/week, $p < 0.05$), and eggs (3.9 servings/week *vs.* 4.6 servings/week, $p < 0.05$).
Conclusion: Constipation is common in Taiwanese school-aged children, especially in girls. Less frequent consumption of vegetables, fruits, soybean products, and eggs is associated with childhood constipation. Establishing a regular bowel habit is encouraged to decrease the risk of constipation, and allowing the children a relaxed and sufficient time to defecate after school is essential.

Keywords: Children; Constipation; Nutritional survey; Prevalence

1. Introduction

Constipation is a common disorder worldwide, irrespective of age, gender, and ethnic background. The management of gastrointestinal disorders has significantly improved over the past decade. Despite an improved understanding of the underlying pathophysiology of functional gastrointestinal disorders, childhood constipation remains poorly understood. The major barrier to better understand childhood constipation is the problem of obtaining a precise history. Often researchers rely on parent's interpretations of the children's symptoms, which can lead to incorrect assessments in some situations.[1]

There have been numerous attempts to standardize the definition of constipation in children. Iowa,[2] Rome II, Rome III and Paris criteria have been offered. Some of these efforts have placed a greater emphasis on finding a standard diagnosis, whereas others have had a greater emphasis on management and treatment of the disorder. The Iowa and Rome criteria have advanced and standardized the diagnostic

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criteria for functional gastrointestinal disorders, including childhood constipation. However these rubrics have not fully resolved the controversies related to the diagnostic criteria for childhood constipation. There is still a need for both researchers and the clinicians caring for children to share a common set of diagnostic tools. Further, there is a need to have diagnostic criteria that fit both clinical management and large epidemiologic studies or to have clearly defined different criteria for diagnosis in both settings.[3,4]

The prevalence of childhood constipation has been documented, with highly variable results from study to study and from country to country, ranging from 0.3% to 28%.[5–7] In these studies the differences in prevalence could simply represent the different diagnostic criteria used in each study design. However it may also be partially because of differences in what each culture defines as a "normal" pattern bowel movement.

Despite the variations of prevalence in different countries, there is a global trend of increasing rate of childhood constipation, and this increase remains unexplained.[8–10] Studies of childhood constipation, have been done in many other countries. The current study is the first population-based study of childhood constipation in Taiwan.

Moreover, factors associated with childhood constipation in Taiwan may provide some key information to evaluate the relationship between Chinese dietary patterns and childhood constipation. Therefore, we conducted this study to evaluate the prevalence of childhood constipation in Taiwanese school-aged children and explore the relationship between bowel habits, dietary habits, and childhood constipation through a well-designed population-based study.

2. Methods

The Nutrition and Health Survey in Taiwan (NAHSIT) is a nationwide survey that focused on both the nutrition and the health status of Taiwanese children between 4 and 12 years of age.[11] Our current study is a substudy within the NAHSIT database that focused on the relationship of constipation and dietary factors in elementary school students (aged 7–12 years). Study subjects of NAHSIT were selected through a complex multistaged sampling scheme.[12] Generally speaking, the vast majority of the Taiwanese people belong to the so-called Han people, an inclusive name for various ethnic groups living in central China for centuries. In addition to Han people, Hakka people, primarily located in Northwestern Taiwan, although ethnically similar to Han people, differ from other populations in Taiwan because of their high tendency for intergroup marriage and specific dietary pattern (e.g. consuming higher intake of preserved vegetables and use of lard in cooking). A third culturally distinct group in Taiwan is the aboriginal tribes who are not ethnically Han; they are genetically related to the Malayo-Polynesians. Most of them live in the central mountainous areas, with a low population density. The East Coast area is a stratum isolated from the affluent western part of Taiwan because of the high proportion of aboriginal people living there. The Peng-Hu islands located in the Taiwan Strait are the major offshore islands under Taiwan's jurisdiction. According to the population size of each stratum, three townships (or districts) were selected randomly after the strata were defined. Because of these cultural and ethnic differences, the people studied were subdivided into different groups for comparison.

All 359 townships in Taiwan were divided into thirteen strata according to ethnicity, urbanization index, and geographical characteristics. The study subjects were stratified as follows: areas with high concentration of Hakka people, mountainous areas, the East Coast area, the Peng-Hu islands, and western plain areas of Taiwan (further divided into northern, central, and southern Taiwan). All cities or townships in western plain areas were grouped into three levels by urbanization index (North I–III, Central I–III, and South I–III, respectively). Using the probability proportional to size sampling method, eight schools were selected from each stratum. This produced a total of 104 schools. Random sampling was then used to select four students from each grade in each school, which in turn resulted in a total of 192 students in each stratum.

The total number of selected study subjects was 2,496, and interviews were evenly allocated into each of the two semesters considering seasonally effects. 2,419 subjects agreed to answer the questionnaires, but only a total of 2,375 respondents completed the questionnaire (Fig. 1). Between respondents and nonrespondents, no significant differences in sibling rank and parental characteristics were noted, indicating that this survey was unbiased and representative.[11] The study protocol was reviewed and approved by reviewers from the Department of Health in Taiwan. Trained research staff interviewed every study subject after informed consent was obtained from their parents. Demography, bowel movement history and dietary history were each addressed in a separate section of the interview protocol.

The definition of constipation was made according to the "Iowa criteria" by two or more of the following characteristics during the previous 8 weeks: less than three bowel movements per week, one or more episodes of fecal incontinence per week, large stools in the rectum or felt on abdominal examination, passing of stools so large that they obstruct the toilet, retentive posturing, and painful defecation. The dietary history was obtained by 7-day recall test.

Data in the text were expressed as mean ± standard deviation, and categorical variables were expressed in frequency. Comparisons between continuous variables were done by Student *t* test, and categorical variables were compared by the Chi square test. One-way analysis of variance was used for comparisons between different groups. For all tests, results with *p* values less than 0.05 (two-tailed) were considered statistically significant.

3. Results

3.1. Demographic and associative factors

In total, 2,375 children (1,282 boys and 1,093 girls, 9.3 ± 2.2 years) were enrolled, with a questionnaire response rate of 95.1%. The prevalence of constipation was 32.2%, and girls were more likely to be constipated than boys (36.1% *vs.* 29.2%,

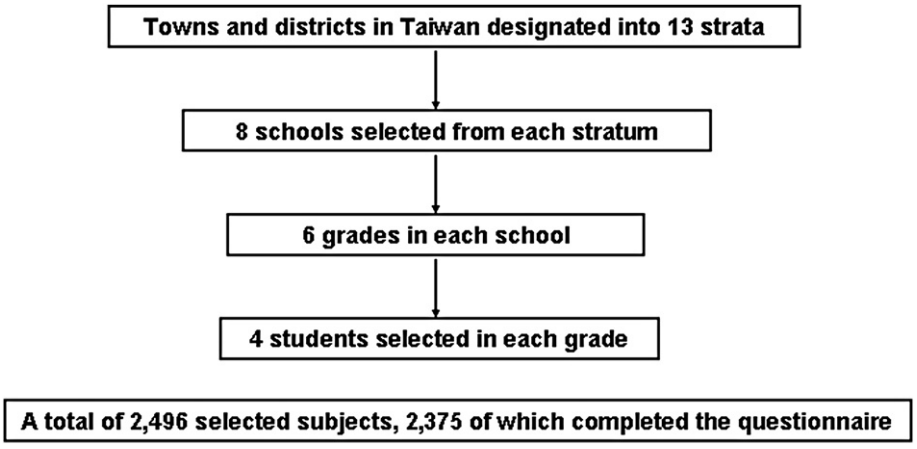

Fig. 1. Structure flow chart of the selected children included in the NAHSIT study.

$p = 0.0012$). There existed an inverse relationship between age and the prevalence of childhood constipation (24.9% for children aged 11 and 12, 34.0% for children aged 9 and 10, and 39.6% for children aged 7 and 8, $p < 0.001$). Regardless of the frequency of stool passage, children who reported regular bowel habit (fixed time during the day) were less likely to be constipated (29.3% *vs.* 37.2%, $p = 0.003$) (Table 1). A regular bowel habit was reported in 59.2% of subjects although the frequency of the regular bowel habit was variable.

When frequency of bowel movement is considered, 44.9% subjects reported stool passage once every 3 days and 2.3% reported longer than 4 days to pass stool once. Boys were more likely to report daily stool passage than girls (56.9% *vs.* 48.4%, $p < 0.001$). The mean body mass index of constipated children was significantly lower (17.5 *vs.* 18.3 kg/m^2, $p < 0.001$). Geographically, the prevalence of constipation was highest in North III district (38.15%), followed by South III district (37.19%), South I (35.97%) district, and areas mainly populated by the Hakka people (36.4%) (Table 2).

Table 1
General characteristics and bowel habits of elementary school-aged children related with constipation

	Constipated, *n* (%)	Not constipated, *n* (%)	*p*
Gender			0.0012
Boys	372 (29.2)	910 (71.8)	
Girls	395 (36.1)	698 (63.9)	
Age (yr)			<0.001
7,8	307 (39.6)	468 (61.4)	
9,10	253 (34.0)	542 (66.0)	
11,12	207 (24.4)	598 (75.6)	
Bowel habit			<0.001
Regular	421 (29.3)	1015 (70.7)	
Irregular	337 (37.2)	570 (62.8)	
Average bowel passage frequency			<0.001
Everyday	217 (17.2)	1041 (72.8)	
Every 2–3 d	485 (47.9)	526 (52.1)	
Every 4 or more days	47 (72.3)	18 (27.7)	

3.2. Dietary factors

The 7-day recall of the dietary analysis evaluated subjects' intake of nonabsorbable carbohydrates, oligosaccharides, meat, eggs, vegetables, fruits, soybean products, fat, and other nutrients. Results showed that constipation was associated with lower intake of vegetables, fruits, soybean products, and eggs (Fig. 2).

4. Discussion

The prevalence of childhood constipation was 32.7% in Taiwan. Earlier studies[4–7] of childhood constipation generally indicated significantly lower rates of this condition. In population-based studies, the prevalence of childhood constipation is difficult to determine the reasons mentioned earlier. Major obstacles derive from the difficulties of obtaining a precise history and the lack of a widely accepted working definition of constipation in population-based studies. Currently, establishing the diagnosis of constipation relies on history alone, which is difficult in all patients but even more difficult in children.[1] Physicians depend on parents' descriptions of their

Table2
Demographic prevalence of childhood constipation in Taiwan

	Constipated		Not Constipated	
	n	%	*n*	%
Hakka areas	67	35.64	119	64.36
Mountain areas	62	33.94	123	66.05
Eastern areas	49	23.95	139	76.04
Peng-Hu islands	50	26.91	136	73.08
Northern areas: first stratum	41	24.95	125	75.05
Northern areas: second stratum	54	30.35	122	69.65
Northern areas: third stratum	69	38.15	119	61.85
Central areas: first stratum	61	32.37	127	67.64
Central areas: second stratum	67	34.30	127	65.70
Central areas: third stratum	57	35.23	107	64.76
Southern areas: first stratum	67	35.97	117	64.03
Southern areas: second stratum	53	29.39	134	70.61
Southern areas: third stratum	70	37.19	113	62.81
Total	767	32.25	1,608	67.75

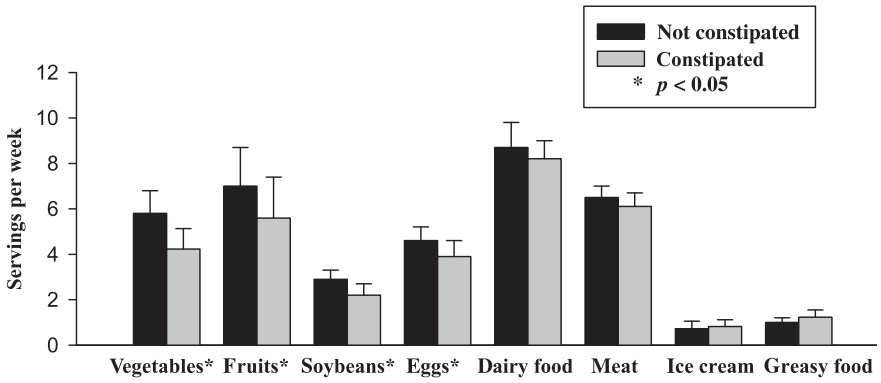

Fig. 2. Dietary habits and their relation with constipation in Taiwan elementary school children.

child's behavior in many aspects of pediatric care, and certainly with constipation they do as well. The perspectives of the physician, parent, and child may all be different, and this may lead to inconsistencies in data about constipation.

The Iowa criteria have been the most commonly used tool to assess childhood constipation because of the practicality in clinical practice and clinical effectiveness evaluation.[2] Although the Rome criteria were developed to facilitate clinicians defining functional gastrointestinal disorders, the introduction of the Rome criteria did not end the arguments about diagnostic criteria for the diagnosis of childhood constipation. Furthermore, it did not improve the convenience and functionality for diagnosis of constipation in clinical practice.[3,12]

The range in prevalence of constipation for adults living both in Western and Asian countries is between 10% and 20%. The range in prevalence in children is much greater, between 0.3% and 28%.[13−15] Nevertheless, the estimates of childhood constipation have been escalating in the last decade.[4] Whether the high prevalence is related to the true growing popularity of constipation or merely the results of changing perceptions to childhood constipation remains unclear. Some studies have reported a two-fold higher rate of constipation in boys,[16,17] however other studies show approximately the same rate for boys and girls.[18,19] However, the tendency of adult women to be more likely to be constipated remains consistent, and the ratio increases with age.[20,21] It was hypothesized that girls recognized symptoms of constipation better than boys because of their earlier physiological development and toilet training.

We identified an inverse relationship between age and the prevalence of childhood constipation from our acquired data. We speculate that younger children have not yet mastered their toilet training and tend to fear the experience of defecation, whereas older children are more likely to have established regular bowel habits and are less stressed to defecate. A study by Medeiros et al.[22] demonstrated that observing children with chronic constipation, those in the preschool age were more likely to show symptoms of retentive posturing and fear of defecation than those of school age and adolescents. This may explain why older children in our study were less constipated.

In Taiwan, it is commonly believed that increased intake of fluid, nonabsorbable carbohydrates, or fibers may facilitate bowel movement. In this study, a lower intake of vegetables, fruits, soybean products, and eggs was significantly associated with childhood constipation. However, because of the difficulty of precise evaluation of daily fluid intake from questionnaires, we couldn't establish noticeable data to define the association of fluid intake and constipation. There were previous reports that showed increased water intake had little effect on bowel movement,[23,24] and that increasing dietary fiber may ameliorate childhood constipation.[25−27] We suggest further studies should be taken to explore the dietary factors of constipation before establishing more definite conclusions.

Children with constipation were found to be statistically thinner in our survey. This result is contrary to recent studies implicating the association of obesity with constipation. Because of the many confounding factors noted in our study such as gender, diet, and bowel habits, this finding may not apply to the general population but is simply an observational result. Additional studies are required to identify the association.

In conclusion, constipation is common in Taiwanese elementary school-aged children, especially in girls. Having fewer servings of vegetables, fruits, soybean products, and eggs was associated with constipation among children aged 7−12 years. Establishing regular bowel habits may decrease the risk of constipation. Allowing children adequate time to relax and defecate after school is a prudent recommendation to parents. Because constipation is so common and because of its impact on families and public health, further studies should be done to more clearly define the basic pathophysiology and epidemiology of this condition.

References

1. Lembo AJ, Ullman SP. Constipation. In: Feldman M, Friedman LS, Sleizenger MH, editors. *Sleizenger & Fordtran's gastrointestinal and liver disease*. 7th ed. Philadelphia: WB Saunders; 2002. p. 181−210.
2. Loening-Baucke V. Modulation of abnormal defecation dynamics by biofeedback treatment in chronically constipated children with encopresis. *J Pediatr* 1990;**116**:214−22.
3. Voskuijl WP, Heijmans J, Heijmans HS, Taminiau JA, Benninga MA. Use of Rome II criteria in childhood defecation disorders: applicability in clinical and research practice. *J Pediatr* 2004;**145**:213−7.
4. Benninga M, Candy DC, Catto-Smith AG, Clayden G, Loening-Baucke V, Di Lorenzo C, et al. The Paris Consensus on Childhood Constipation Terminology (PACCT) Group. *J Pediatr Gastroenterol Nutr* 2005;**40**: 273−5.

5. Sonnenberg A, Koch TR. Physician visits in the United States for constipation: 1958 to 1986. *Dig Dis Sci* 1989;**34**:606−11.
6. Talley NJ, Jones M, Nuyts G, Dobois D. Risk factors for chronic constipation based on a general practice sample. *Am J Gastroenterol* 2003;**98**: 1107−11.
7. Talley NJ, Weaver AL, Zinsmeister AR, Melton 3rd LJ. Functional constipation and outlet delay: a population-based study. *Gastroenterology* 1993;**105**:781−90.
8. Partin JC, Hamill SK, Fischel JE, Partin JS. Painful defecation and faecal soiling in children. *Pediatrics* 1992;**89**:1007−9.
9. Borowitz SM, Cox DJ, Tam A, Ritterband LM, Sutphen JL, Penberthy JK. Precipitants of constipation during early childhood. *J Am Board Fam Pract* 2003;**16**:213−8.
10. Petticrew M, Watt I, Sheldon T. Systematic review of the effectiveness of laxatives in the elderly. *Health Technol Assess* 1997;**1**:1−52.
11. Tu SH, Hung YT, Chang HY, Hang CM, Shaw NS, Lin W, et al. Nutrition and Health Survey of Taiwan Elementary School Children 2001−2002: research design, methods and scope. *Asia Pac J Clin Nutr* 2007;**16**:507−17.
12. Nurko S. Advances in the management of paediatric constipation. *Curr Gastroenterol Rep* 2000;**2**:234−40.
13. Molnar D, Taitz LS, Urwin OM, Wales JK. Anorectal manometry results in defecation disorders. *Arch Dis Child* 1983;**58**:257−61.
14. Loening-Baucke V. Constipation in early childhood: patient characteristics, treatment, and long-term follow up. *Gut* 1993;**34**:1400−4.
15. Araujo Sant'Anna AM, Calcado AC. Constipation in school-aged children at public schools in Rio de Janeiro, Brazil. *J Pediatr Gastroenterol Nutr* 1999;**29**:190−3.
16. van der Plas RN, Benninga MA, Büller HA, Akkermans LM, Redekop WK, Taminiau JA. Biofeedback training in treatment of childhood constipation: a randomized controlled study. *Lancet* 1996;**348**:776−80.
17. van Ginkel R, Buller HA, Boeckxstaens GE, van der Plas RN, Taminiau JAJM, Benninga MA. The effect of anorectal manometry on the outcome of treatment in severe childhood constipation: a randomised, controlled trial. *Pediatrics* 2001;**108**:E9.
18. Corazziari E, Cucchiara S, Staiano A, Romaniello G, Tamburrini O, Torsoli A, et al. Gastrointestinal transit time, frequency of defecation, and anorectal manometry in healthy and constipated children. *J Pediatr* 1985; **106**:379−82.
19. Levine MD. Children with encopresis: a descriptive analysis. *Pediatrics* 1975;**56**:412−6.
20. Sonnenberg A, Koch TR. Epidemiology of constipation in the United States. *Dis Colon Rectum* 1989;**32**:1−8.
21. Heaton KW, Radvan J, Cripps H, Mountford RA, Braddon FE, Hughes AO. Defecation frequency and timing, and stool form in the general population: a prospective study. *Gut* 1992;**33**:818−24.
22. Medeiros LCS, Morais MB, Tahan S, Fukushima E, Motta MEFA, Fagundes-Neto U. Clinical characteristics of pediatric patients with chronic constipation according to age group. *Arq Gastroenterol* 2007;**44**: 340−4.
23. Chung BD, Parekh U, Sellin JH. Effect of increased fluid intake on stool output in normal healthy volunteers. *J Clin Gastroenterol* 1999;**28**:29−32.
24. Ziegenhagen DJ, Tewinkel G, Kruis W, Herrmann F. Adding more fluid to wheat bran has no significant effects on intestinal functions of healthy subjects. *J Clin Gastroenterol* 1991;**13**:525−30.
25. Morais MB, Vitolo MR, Aguirre AN, Fagundes-Neto U. Measurement of low dietary fiber intake as a risk factor for chronic constipation in children. *J Pediatr Gastroenterol Nutr* 1999;**29**:132−5.
26. McClung HJ, Boyne L, Heitlinger L. Constipation and dietary fibre intake in children. *Pediatrics* 1995;**96**:999−1000.
27. Constipation Guideline Committee of the North American Society for Pediatric Gastroenterology, Hepatology and Nutrition. Evaluation and treatment of constipation in infants and children: recommendations of the North American Society for Pediatric Gastroenterology, Hepatology and Nutrition. *J Pediatr Gastroenterol Nutr* 2006;**43**:405−7.